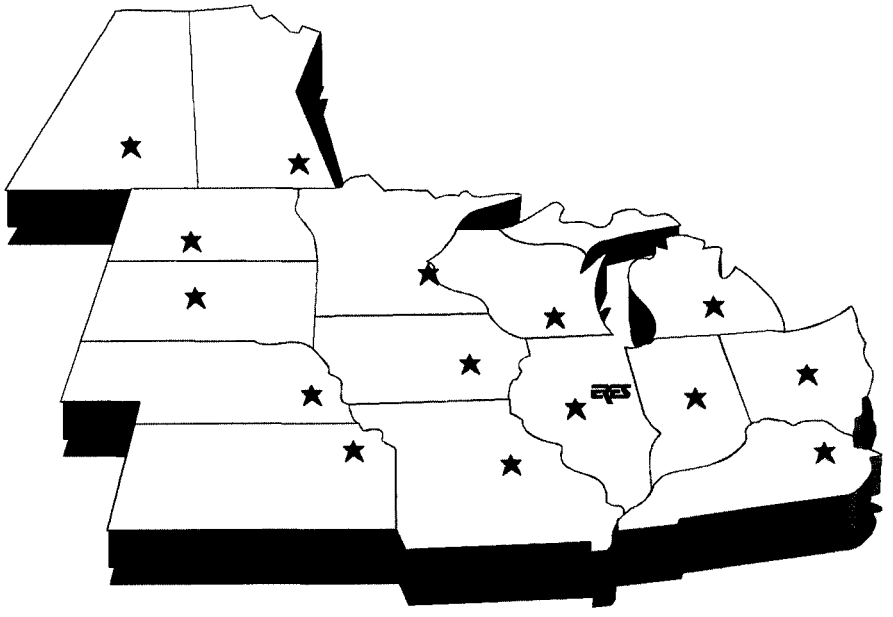
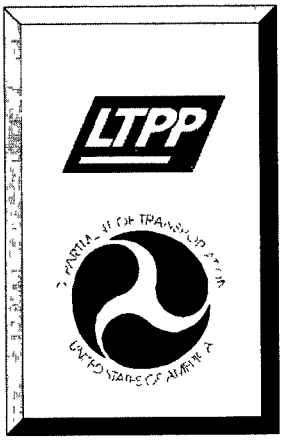
Construction Report for Ohio SPS-1

DTFH61-96-C-00013

September 28, 1998





Submitted by

ERES CONSULTANTS, INC.

SPS-1 Construction Report
U.S. Highway 23, Southbound
Delaware County, Ohio
30 Miles North of Columbus, Ohio

Sections 390101 to 390112, 390159 and 390160

Federal Highway Administration
LTPP Division
North Central Region

Report Prepared By:
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September 28, 1998

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Attachments

1

Project Overview

The Strategic Highway Research Program (SHRP) SPS-1 experimental project investigates the effect of structural factors in long term pavement performance of flexible pavements. The study objective includes a determination of the influence of environmental region and soil type on these factors. Accomplishing these objectives will provide substantially improved tools for use in the design and construction of new and reconstructed flexible pavements.

The factors studied include:

- Surface layer thickness
- Base course thickness
- Base type (material)
- Drainage (permeability)

These criteria will help provide conclusive results to be used in the design and construction of new and rehabilitated flexible pavements.

The Ohio SPS-1 site includes 12 SHRP test sections and 2 Ohio Department of Transportation (ODOT) test sections. Field tests and samples are obtained at different stages of construction from each test section. All samples are taken from the outer lane.

1.1 Experimental Cell

This project includes pavements on fine-grained active soils in the wet-freeze environmental zone. The subgrade soil generally falls into the F4 group, which is the most highly frost-susceptible classification.

1.2 Project Location

The Ohio SPS-1 site is located about 30 miles north of Columbus, Ohio on southbound U.S. 23. More specifically, the site runs parallel to Delaware Lake about two miles south of Waldo, Ohio. The test site is 3.37 miles long. See Attachment A for project maps.

1.3 Road and Traffic Characteristics

This four-lane section of U.S. 23 is classified as a rural arterial. Table 1 shows traffic data at the time of construction.

Table 1. Traffic Data for Ohio SPS-1.

Current average daily traffic (1994)	20210 vehicles
Design year average daily traffic (2014)	30320 vehicles
Design period	20 years
Design hourly volume	2426 vehicles
Truck distribution	12%
Directional distribution	55%
Design speed	55 miles per hour
Legal speed	55 miles per hour

The roadway is relatively straight and flat with a maximum southbound grade not exceeding .68 percent. The lanes are 12 feet wide with an outside shoulder of 10 feet and an inside shoulder of four feet.

1.4 Weather Monitoring

During construction a site was prepared between stations 391+00 and 392+00 for a weather monitoring station. This unit was installed in 1995.

1.5 Pavement Instrumentation

A weigh-in-motion (WIM) system was installed to classify all individual single/tandem wheels in all lanes of this section of U.S. 23. The WIM equipment used in this project was manufactured by Mettler-Toledo, Inc. Their address is:

60 Collegeview Road
Westerville, Ohio 43081
Phone: (614) 841-5110

The WIM scale (in each lane) consists of two weigh plates mounted in the pavement which cover the entire 12-foot lane width. The WIM device is located at station 366+77.5 in the southbound direction. This is centrally located among the SPS test sections, and so it is a very accurate measurement of traffic data.

Instrumentation was also installed in each pavement layer to record load response parameters and environmental data. Load response data include strain, deflection and pressure. Environmental data include moisture conditions, freeze/thaw conditions, temperature of materials, and other parameters. These sensors will be located at instrumentation sites evenly located along the length of the test site.

1.6 Subsurface Structures

According to construction data sheets, several sections contain underground drainage structures. These test sections were located over drainage blankets with longitudinal

drains running continuously along the sections. The affected sections are: 390107, 390108, 390109, 390110, 390111, 390112 and 390160.

1.7 Known Deviations From Guidelines

See Attachement D for project deviation sheets.

1.8 Construction and Traffic Scheduling

Preparation of the embankment began as early as October 1994. In the spring of 1995, it was determined that some of the embankment was unsuitable. The embankment in these locations was removed, new fill was placed, and these sections were resampled. Subgrade preparation was completed by August of 1995. Base layer and asphalt placement was performed during September and October of 1995. The test sections were opened to traffic in November 1995.

1.9 Personnel

North Central Regional Coordination Office:

Tom Wilson
Co-Principal Investigator
505 West University Avenue
Champaign, Illinois 61820
(217) 356-4500

Field Crew:

Roger Green
Brad Young, certified field crew chief
Ohio Department of Transportation
1600 West Broad Street
Room 2025
Columbus, Ohio 43223
(614) 275-1394

Contractors:

Asphalt Paving
SE Johnson
1120 Milligan Court
Sidney, Ohio 45365-9196
(937)492-0027

1.10 Summary of Key Construction Equipment

The following equipment was used during construction.

Subgrade Preparation

- 22.1-ton sheepsfoot roller

Unbound Base Layer Placement

- 16.5-ton single drum vibratory roller
- CMI trimming machine

Asphalt Treated Base Layer Placement

- Blaw Knox PF-200B paver
- Asphalt drum mix plant
- 7.0-ton steel-wheel tandem roller
- 8.0-ton three-wheel steel roller

Asphalt Paving

- 7.0-ton steel-wheel tadem roller
- 8.0-ton three-wheel steel roller
- Pneumatic rubber-tired roller at 100 psi
- Blaw Knox PF-200B paver
- Asphalt drum mix plant

Placement of Asphaltic Concrete Pavement

- Blaw Knox PF200B Paver

2

Project Details

The layout of the project is shown in attachment B. Each test section is 500 ft long, not including a 50-ft monitoring section at each end. The pavement layer materials and nominal thickness for all sections are shown in table 2.

Figure B-2 in attachment B shows the site details used to identify test sections.

Table 2. Ohio SPS-1 Section Layout.

Construction Station	SHRP ID	AC Thickness (in) (Layer 1)	Mat'l and Thickness (in) (Layer 2)	Mat'l and Thickness (in) (Layer 3)	Mat'l and Thickness (in) (Layer 4)	Drainage
325+00 to 320+00	390112	4	ATB 12	PATB 4	-	Yes
333+00 to 328+00	390111	4	ATB 8	PATB 4	-	Yes
341+00 to 336+00	390104	7	ATB 12	-	-	No
348+00 to 343+00	390106	7	ATB 8	DGAB 4	-	No
355+00 to 350+00	390101	7	DBAG 8	-	-	No
363+00 to 358+00	390107	4	PATB 4	DGAB 4	-	Yes
375+00 to 370+00	390102	4	DGAB 12	-	-	No
382+00 to 377+00	390160*	4	ATB 11	DGAB 4	-	No
392+50 to 387+50	390105	4	ATB 4	DGAB 4	-	No
399+75 to 394+75	390108	7	PATB 4	DGAB 8	-	Yes
406+50 to 401+50	390109	7	PATB 4	DGAB 12	-	Yes
413+50 to 408+50	390110	7	ATB 4	PATB 4	-	Yes
420+75 to 415+75	390103	4	ATB 8	-	-	No
433+00 to 428+00	390159*	4	ATB 15	CTPB 4	DGAB 6	Yes

* Ohio DOT test sections Other sections are SHRP.

Note:
AC = Asphalt Concrete
ATB = Asphalt Treated Base
DGAB = Dense Graded Aggregate Base
PATB = Permeable Asphalt Treated Base
CTPB = Cement Treated Permeable Base

2.1 Construction Activities

This section describes the general procedure used to prepare all sections to specification.

Subgrade Preparation

The subgrade of all sections was prepared using a 22.1-ton sheepsfoot roller. Typical lift thickness was 12 in. It should be noted that section 390105 originally had 20 in of embankment, which was deemed unsuitable during the fall of 1994. Therefore, the embankment was cut down to 4 inches in the spring of 1995. Subgrade sampling, which occurred during the spring of 1994, will have to be redone.

Dense-Graded Aggregate Base (DGAB) Placement

Preparation of the DGAB layer was performed in the fall of 1995. A 16.5-ton single drum vibratory roller was used for compaction. Lift thickness ranged from 7 to 10 in, depending on the desired thickness of the layer. Where a 12 in DGAB layer was desired, two lifts of 7 and 8 in were typically used. All DGAB layers were cut to grade using a CMI trimming machine.

Permeable Asphalt-Treated Base (PATB) and Asphalt-Treated Base (ATB)

Asphalt for both the PATB and ATB layers was obtained from Amoco in Toledo, Ohio. Both types of layers were set down by a Blaw Knox PF 200B paver, with a single pass laydown width of 12.5 ft.

The asphalt-treated base was compacted using one to four lifts, depending on desired thickness. Each lift was typically broken down by 10 passes of an 8.0-ton three-wheel steel roller. Final compaction was done by approximately 10 passes of a 7.0-ton steel-wheel tandem roller. Laydown temperature for this layer averaged around 260 °F.

To allow for greater permeability, compaction of the PATB layer was done by 14 passes of a 7.0-ton steel-wheel tandem roller. Laydown temperature for this layer averaged 180° F.

Asphalt Concrete Plant

Asphalt concrete for this project was produced by a Stonco Drum Mix Plant, located about 25 miles (35 minutes) from this project.

Asphalt Paving

The asphalt concrete was placed with a Blaw Know Model PF200B paver. The asphalt had a mean laydown temperature of about 265 °F. Typically, the surface layer was compacted by the following method. Breakdown compaction was performed by about 10 passes of an 8.0-ton three-wheel steel roller. A pneumatic-tired roller at 100 psi was used

for intermediate compaction. Lastly, a 7.0-ton steel-wheel tandem roller made the final passes. For the binder layer compaction procedure, omit the intermediate pneumatic-tired roller.

Table 3. Construction Schedule.

Test Section		Construction		Range of Thickness
Layer	Designation	Start	Complete	
1	Subbase	October 1994	August 1995	-
2	DGAB	August 1995	October 1995	0"-12"
3	PATB	August 1995	October 1995	0"-4"
4	ATB	August 1995	October 1995	0"-15"
5	Surface	August 1995	October 1995	4"-7"

2.2 Objectives for Material Sampling and Testing

Material sampling and field testing (MST) are required at different stages of construction. LTPP sampling and field testing procedures have been developed specifically for the SHRP program. All activities were performed in accordance with these guidelines unless otherwise specified. The following sections specify the sampling and field tests that were performed on each layer.

Subgrade

- Obtained thin-wall tube samples.
- Obtained bulk samples and moisture samples.
- Conducted moisture and density tests using the nuclear gauge on the prepared subgrade surface.
- Conducted elevation measurements on the prepared subgrade surface.
- Conducted tests using a falling weight deflectometer (FWD) along the outer wheelpath and mid-lane of the compacted subgrade surface.
- Conducted auger probes on the shoulder of test sections to a depth of 20 ft from the prepared subgrade surface to detect the presence of a rigid layer.

Embankment

- Obtained bulk samples and moisture samples.
- Conducted moisture and density tests using the nuclear gauge on the prepared embankment surface.
- Conducted elevation measurements on the prepared embankment surface.
- Conducted FWD tests along the outer wheelpath and mid-lane of the prepared embankment surface.

Dense-Graded Aggregate Base (DGAB)

- Obtained bulk samples of uncompacted permeable asphalt treated base material from the paver or the haul vehicle immediately prior to lay-down.
- Conducted elevation measurements on the prepared surface of the permeable asphalt treated base.
- Conducted FWD tests along the outer wheelpath and mid-lane of the compacted permeable asphalt-treated base.

Asphalt-Treated Base (ATB)

- Obtained bulk samples of uncompacted asphalt-treated base material from the paver or haul vehicle immediately prior to lay-down.
- Conducted nuclear density tests on the compacted asphalt-treated base.
- Conducted elevation measurements on the prepared surface.
- Conducted FWD tests along the outer wheelpath and mid-lane.
- Obtained cores from the asphalt-treated base layer.

Asphalt Concrete (AC)

- Obtained bulk samples of uncompacted asphalt concrete from the paver or haul vehicle immediately prior to laydown. Samples from the intermediate course and the surface course are required.
- Obtained bulk samples of asphalt cement used in the asphalt concrete from the plant.
- Conduct nuclear density tests on the compacted asphalt concrete intermediate course and the surface course.
- Conduct elevation measurements on the prepared asphalt concrete surface.
- Obtain cores from the asphalt concrete layer.

Samples for Long-Term Storage

- Obtained samples of the different types of asphalt cement used for asphalt-based layers.
- Obtained bulk samples of the graded course and fine aggregate used for all asphalt-based layers except the permeable asphalt-treated base.
- Bulk samples of the uncompacted mix from all asphalt-based layers.

2.3 Layout of Material Sampling and Testing Plan

Table 4 shows the naming scheme for all samples taken from all layers.

Table 4. Method for Naming Samples.

B1 – B7	Bulk samples and moisture samples from the prepared subgrade.
B8 – B14	Bulk samples and moisture samples from the prepared embankment.
B16,B18,B19	Bulk samples and moisture samples from the prepared aggregate base.
B15,B17,B20	Bulk samples from uncompacted permeable asphalt-treated material.
B21 – B23	Bulk sample from uncompacted asphalt-treated base.
B24 – B27	Bulk samples of uncompacted asphalt concrete. Obtained samples from intermediate course and surface course.
A1 – A21	Shelby tube samples from subgrade.
S1 – S8	Shoulder probes (20 ft).
T1 – T128	In-place density and moisture tests.
T129 – T155	In-place density tests on prepared asphalt concrete. Performed tests on intermediate course and surface course.
T156 – T197	In-place density tests on prepared asphalt concrete. Perform tests on intermediate course and surface course.
C1 – C69	Asphalt cores. At specified locations obtained cores from the asphalt-treated base in addition to the asphalt concrete cores.

See attachment C for figures showing sampling and testing locations in each layer.

Attachment A

Project Location

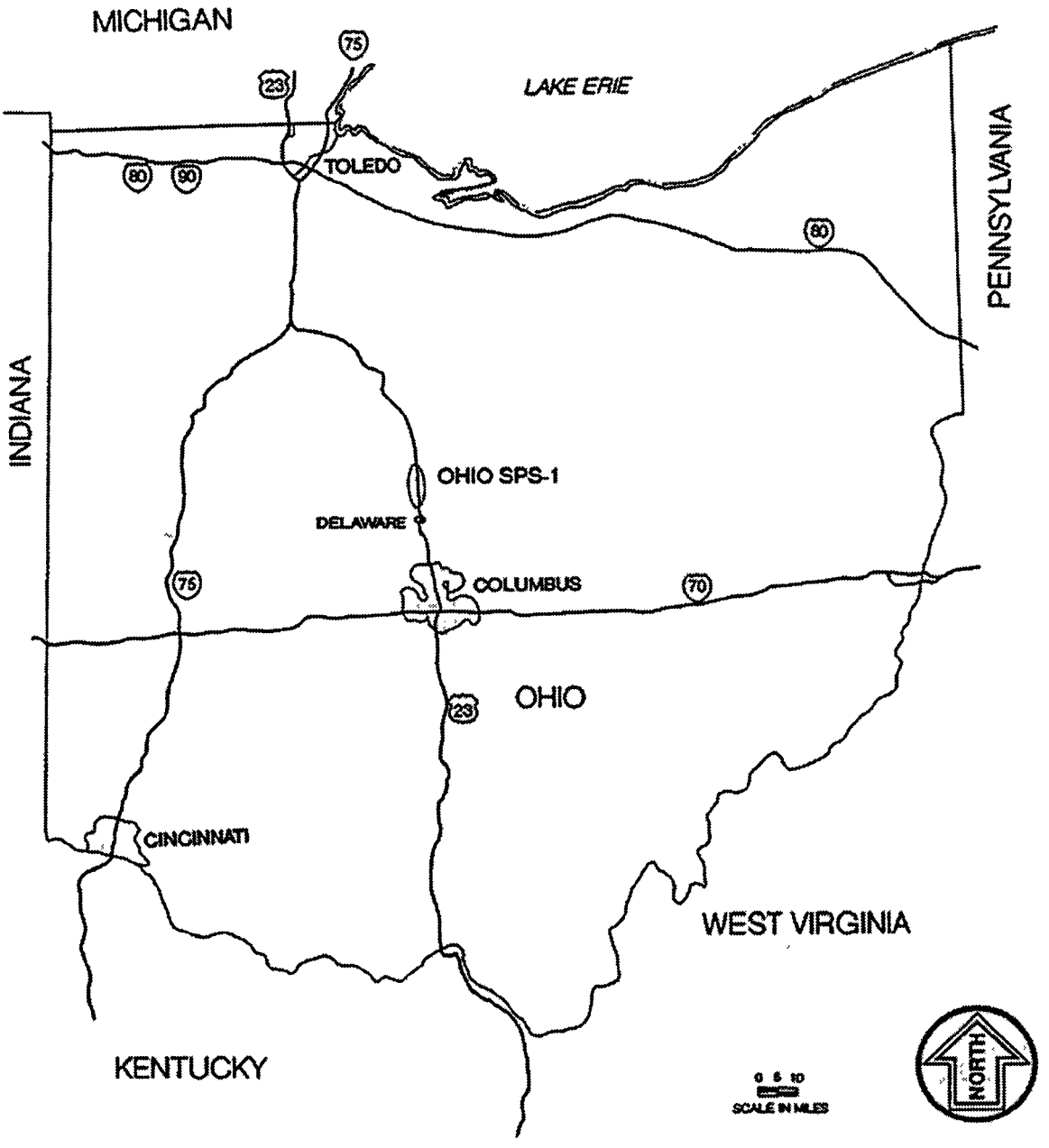


Figure A-1. General Project Location.

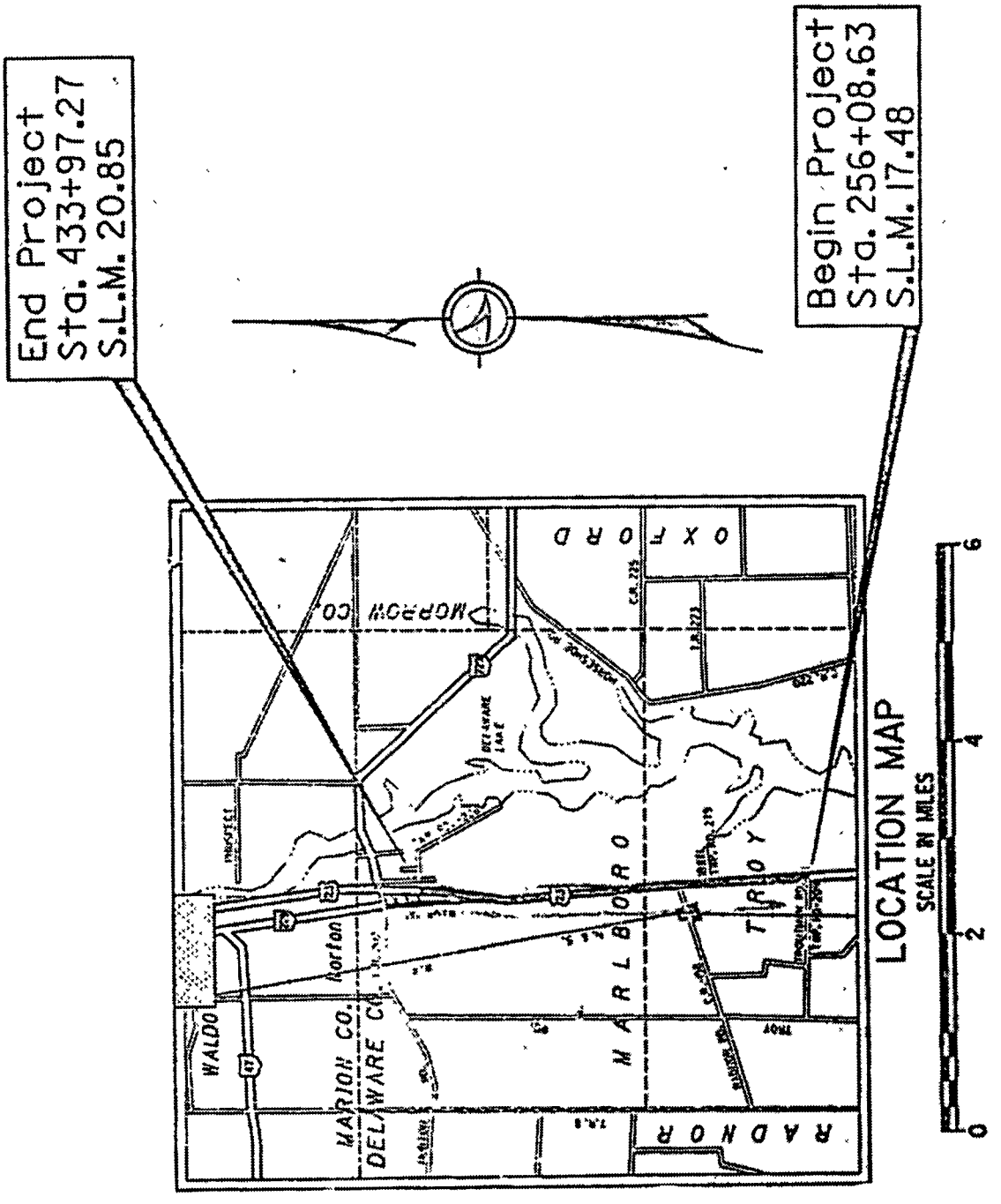


Figure A-2. Detailed Project Location.

Attachment B

Test Site Layout

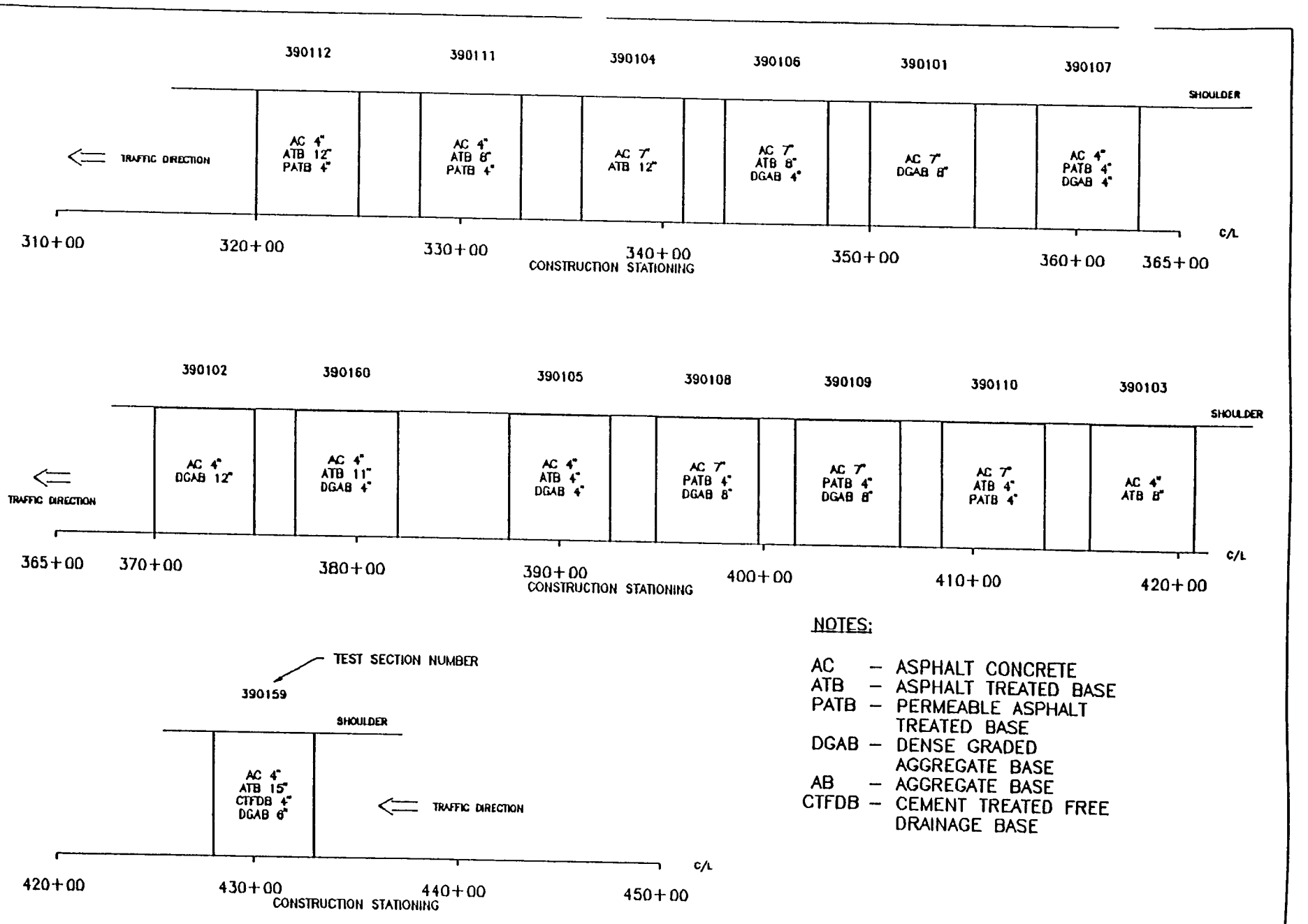


Figure B-1. Test Section Layout.

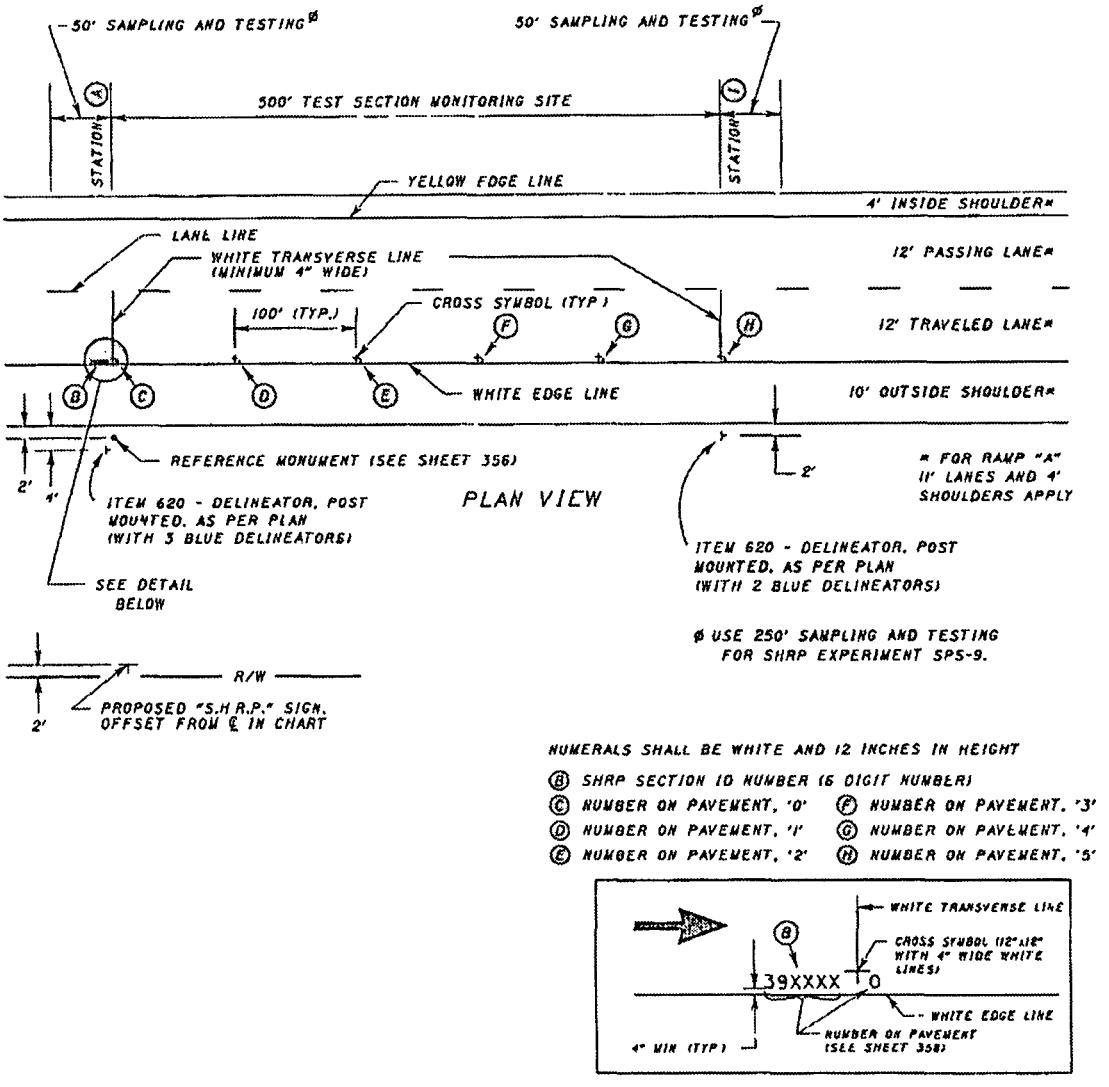
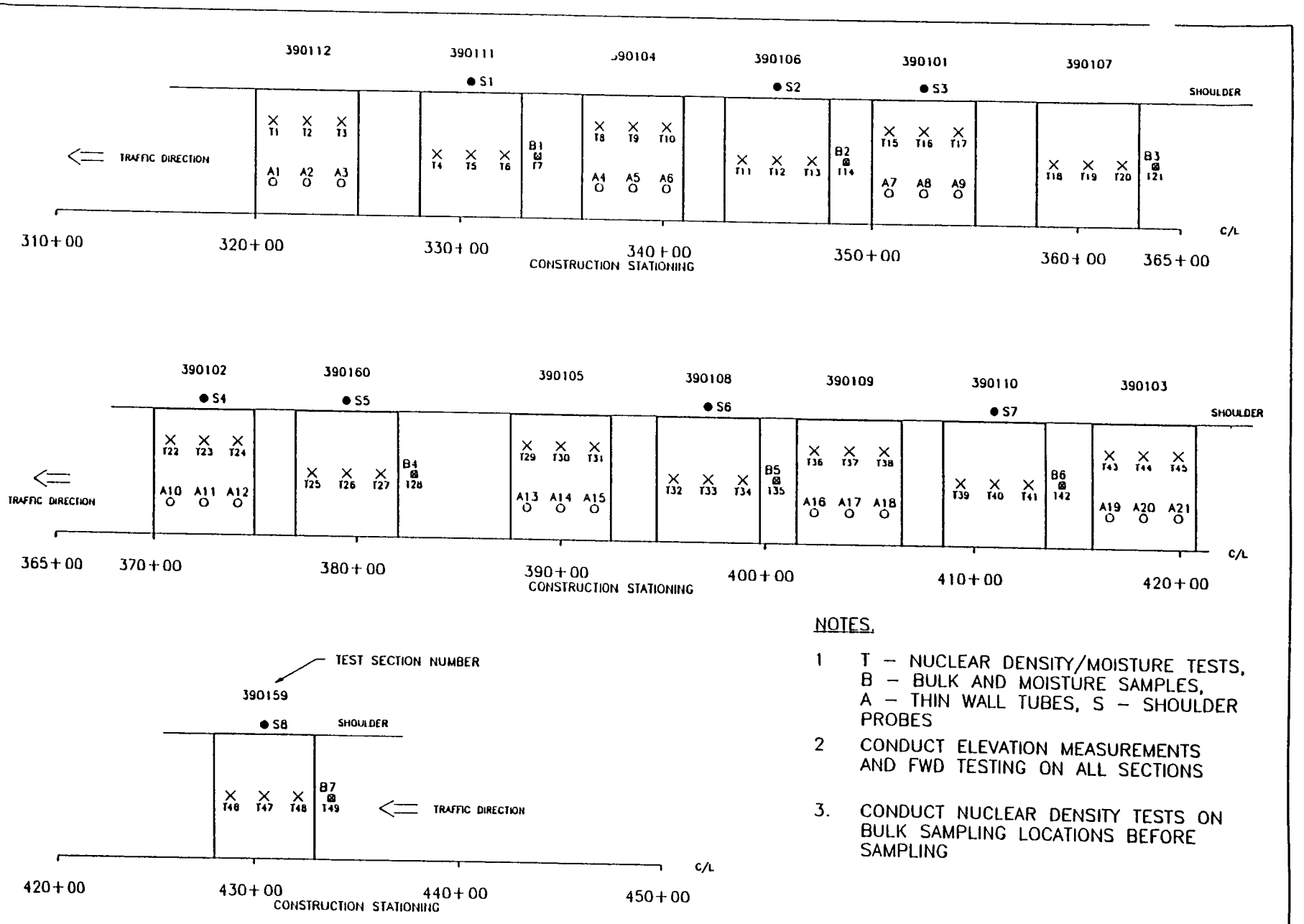


Figure B-2. Test Sections Markings.

Attachment C

Material Sampling and Testing Plan



NOTES.

1 T – NUCLEAR DENSITY/MOISTURE TESTS, B – BULK AND MOISTURE SAMPLES, A – THIN WALL TUBES, S – SHOULDER PROBES

2 CONDUCT ELEVATION MEASUREMENTS AND FWD TESTING ON ALL SECTIONS

3. CONDUCT NUCLEAR DENSITY TESTS ON BULK SAMPLING LOCATIONS BEFORE SAMPLING

Figure C-1. Overview of Sampling and Testing Plan for Subgrade.

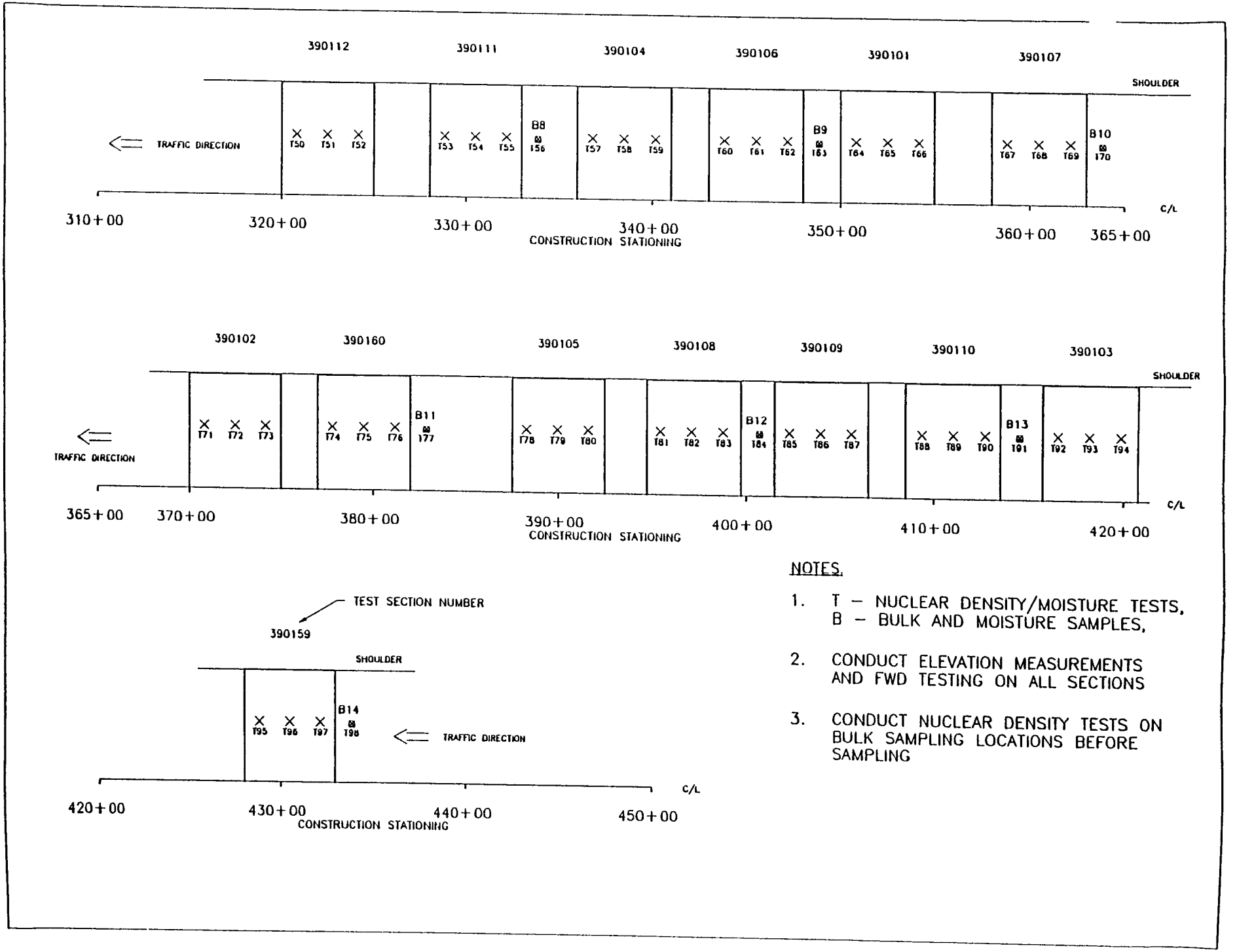


Figure C-2. Overview of Sampling and Testing Plan for Embankment.

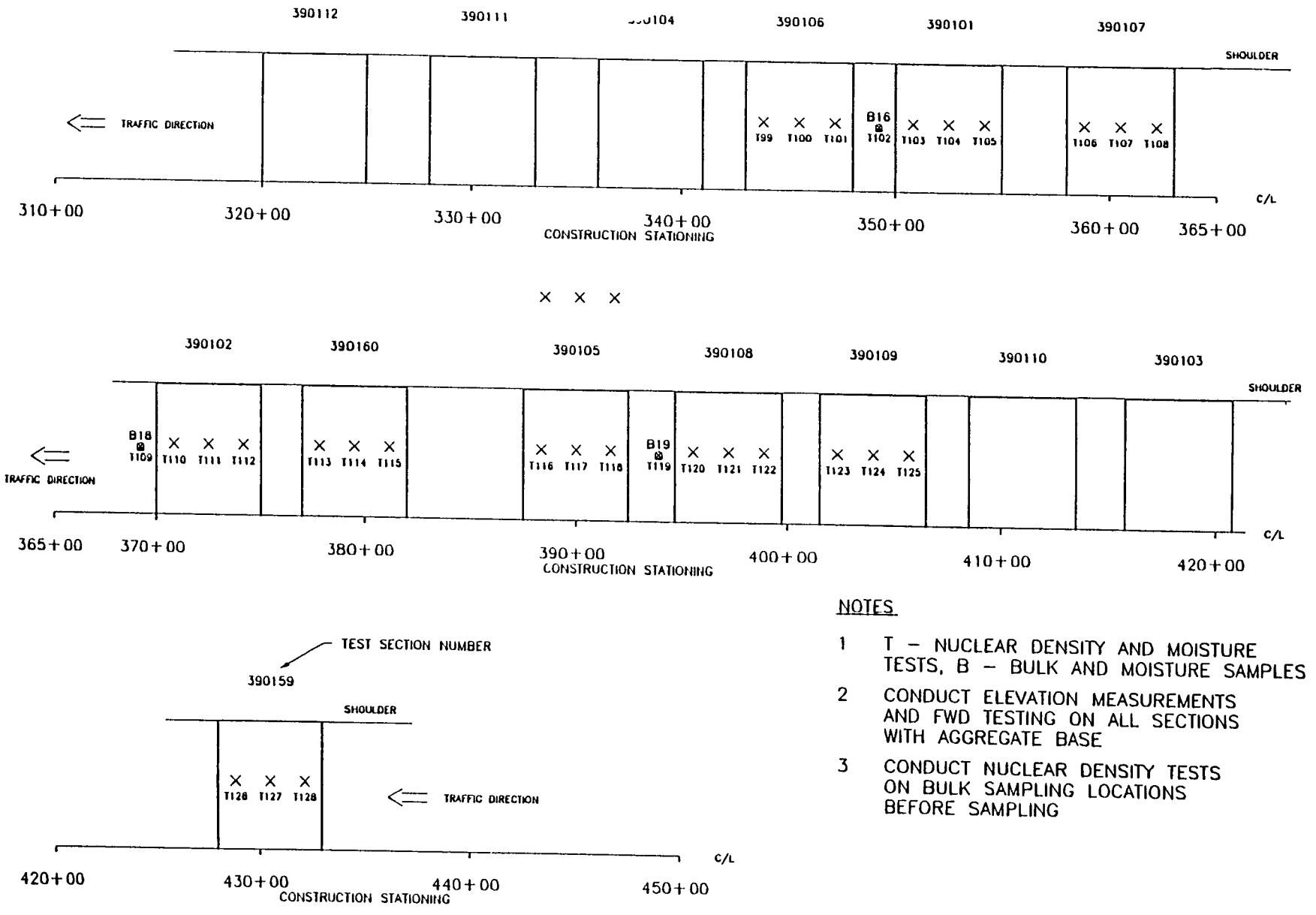


Figure C-3. Overview of Sampling and Testing Plan for DGAB.

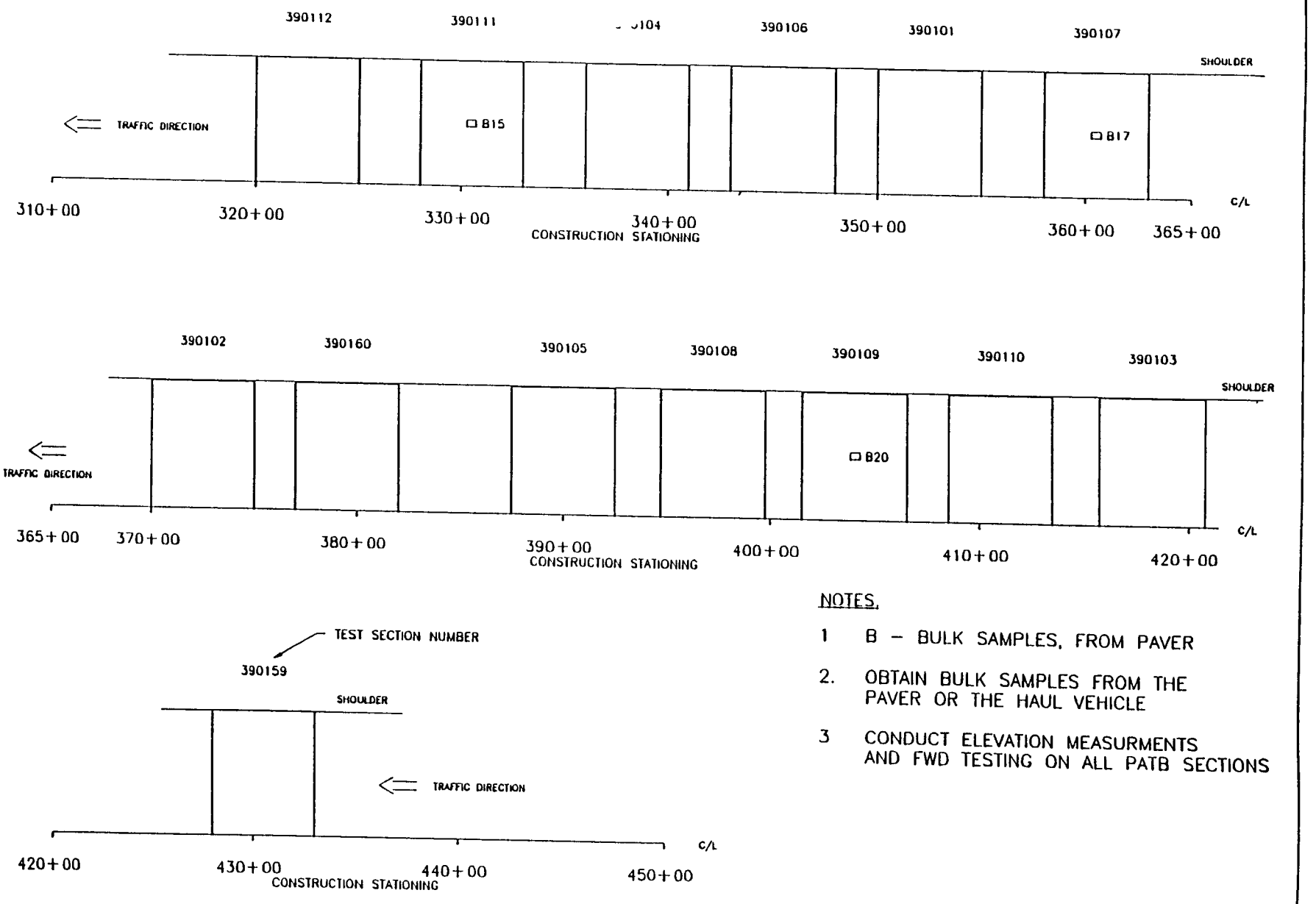
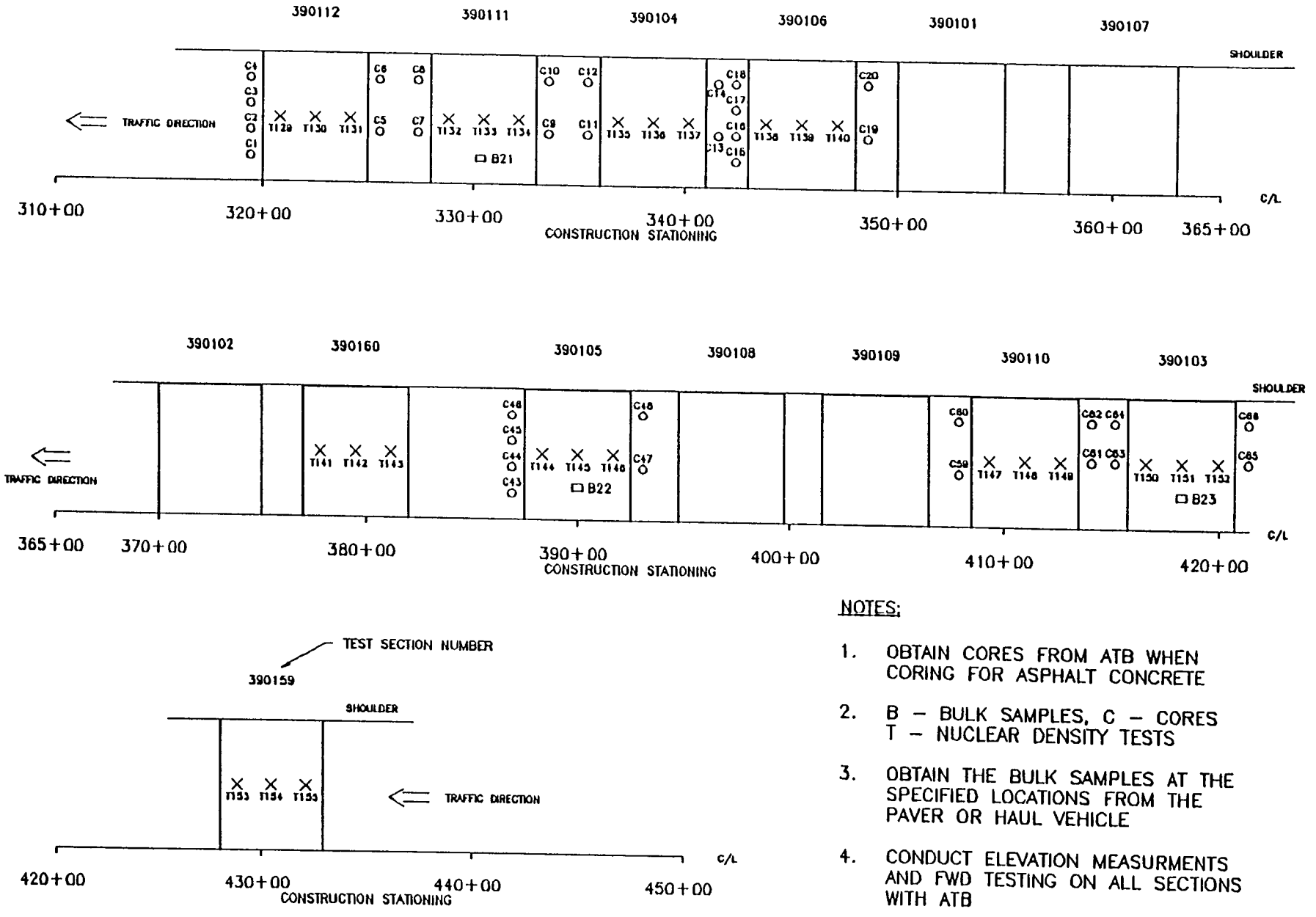


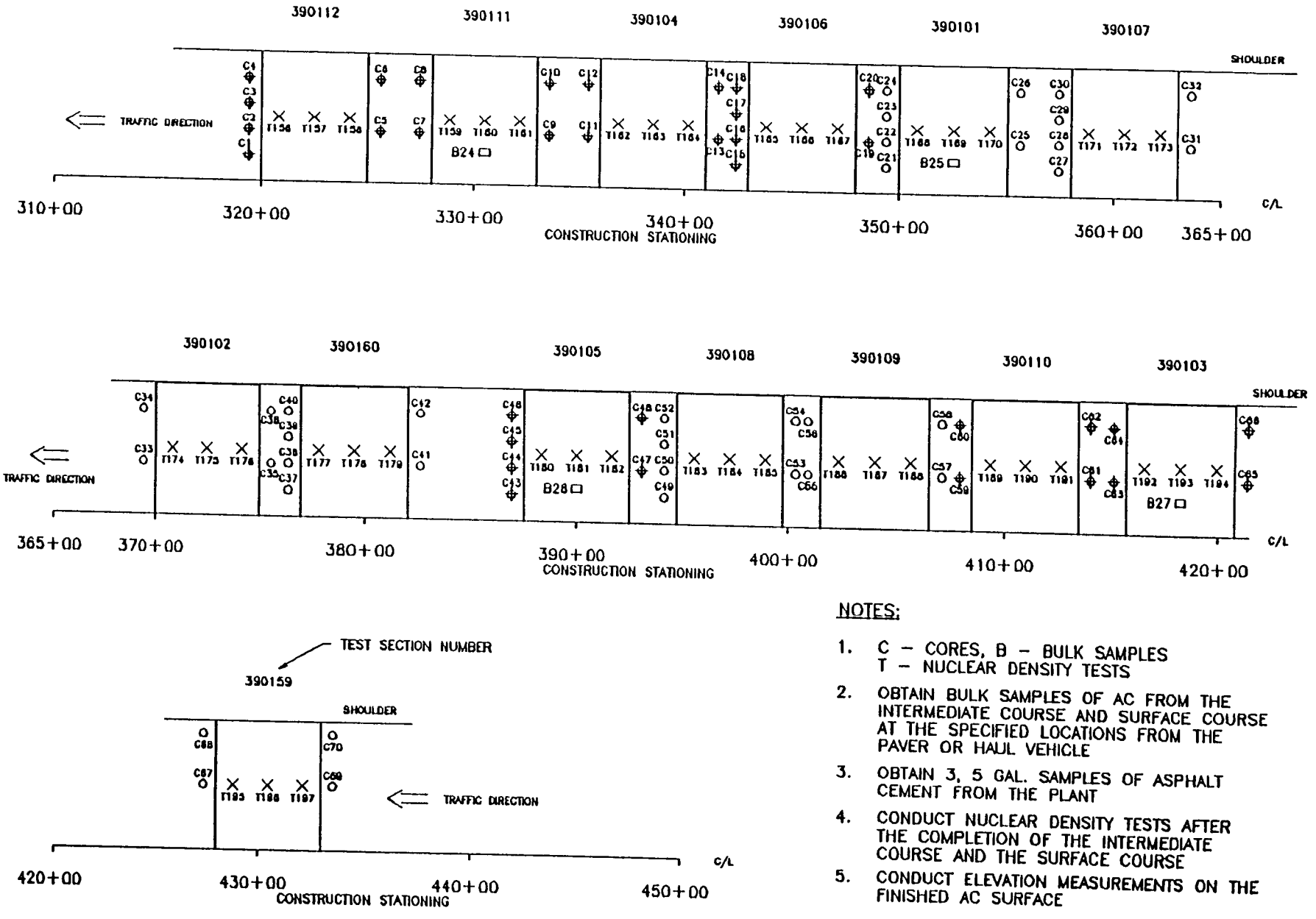
Figure C-4. Overview of Sampling and Testing Plan for PATB.



NOTES:

1. OBTAIN CORES FROM ATB WHEN CORING FOR ASPHALT CONCRETE
2. B – BULK SAMPLES, C – CORES
   T – NUCLEAR DENSITY TESTS
3. OBTAIN THE BULK SAMPLES AT THE SPECIFIED LOCATIONS FROM THE PAVER OR HAUL VEHICLE
4. CONDUCT ELEVATION MEASURMENTS AND FWD TESTING ON ALL SECTIONS WITH ATB

Figure C-5. Overview of Sampling and Testing Plan for ATB.



NOTES:

1. C – CORES, B – BULK SAMPLES
   T – NUCLEAR DENSITY TESTS
2. OBTAIN BULK SAMPLES OF AC FROM THE INTERMEDIATE COURSE AND SURFACE COURSE AT THE SPECIFIED LOCATIONS FROM THE PAVER OR HAUL VEHICLE
3. OBTAIN 3, 5 GAL. SAMPLES OF ASPHALT CEMENT FROM THE PLANT
4. CONDUCT NUCLEAR DENSITY TESTS AFTER THE COMPLETION OF THE INTERMEDIATE COURSE AND THE SURFACE COURSE
5. CONDUCT ELEVATION MEASUREMENTS ON THE FINISHED AC SURFACE

Figure C-6. Overview of Sampling and Testing Plan for Asphalt Concrete.

Attachment D

Project Deviation Reports

LTPP SPS Project Deviation Report **Project Summary Sheet**	State Code 3 9 Project Code 0 1 0 0

Project Classification Information	
SPS Experiment Numbér: SPS-1	State or Province: Ohio
LTPP Region:	☐ North Atlantic ☒ North Central ☐ Southern ☐ Western
Climate Zone:	☒ Dry-Freeze ☐ Dry-No Freeze ☐ Wet-Freeze ☐ Wet-No Freeze
Subgrade Classification:	☒ Fine Grain ☐ Coarse Grain ? ☐ Active (SPS-8 Only)
Project Experiment Classification Designation (SPS 1, 2, & 8): SPS-1	
Construction Start Date: October 1994	Construction End Date: October 1995
FHWA Incentive Funds Provided to Agency for this Project:	☒ Yes ☐ No

Deviation Summary	
Site Location Deviations:	☒ No Deviations ☐ Minor Deviations ☐ Significant Deviations
Construction Deviations:	☐ No Deviations ☒ Minor Deviations ☐ Significant Deviations

Data Collection and Processing Status Summary	
Inventory Data (SPS 5,6,7, & 9):	☐ Complete Submission ☐ Incomplete ☐ Data Not Available
Materials Data:	☒ All Scheduled Samples Obtained and Tested ☐ Incomplete
Construction Data:	☒ All Required Data Obtained ☐ Incomplete / Missing Data Elements
Historical Traffic Data:	☐ All Required Historical Estimates Submitted (SPS 5, 6, 7, & 9) ☐ Required Estimates Not Submitted
Traffic Monitoring Equipment:	☒ WIM Installed On-Site ☐ AVC Installed On-Site ☐ ATR Installed On-Site ☐ No Equipment Installed
Traffic Monitoring:	☐ Preferred ☒ Continuous ☐ Minimum ☐ Below Minimum ☐ Site Related
Traffic Monitoring Data:	☒ Monitoring Data Submitted ☐ No Monitoring Data Submitted
FWD Measurements:	☒ Pre-construction Tests Performed ☐ Construction Tests Performed ☒ Post-construction Tests Performed
Profile Measurements:	☐ Pre-construction Tests Performed ☒ Post-construction Tests Performed
Distress Measurements	☐ Pre-construction Tests Performed ☒ Post-construction Tests Performed
Maintenance and Rehab. Data:	☒ Complete Submission ☐ Incomplete ☐ Data Not Available
Friction Data:	☒ Complete Submission ☐ Incomplete ☐ Data Not Available

Report Status	
Materials Sampling and Test Plan:	☐ Document Prepared ☒ Final Submitted To FHWA
Construction Report:	☒ Document Prepared ☐ Final Submitted To FHWA
AWS: (SPS 1, 2, & 8) NA	☒ AWS Installed ☐ AWS Installation Report Submitted to FHWA

 Preparer Mike Pozsgay Date 9-14-1998

LTPP SPS Project Deviation Report Construction Guidelines Deviation	State Code 39 Project Code 0 1 0 0

☒ Comments Pertain to All Test Sections on Project

☐ Comments Pertain Only to Section(s): (Specify) _____

Construction Guidelines Deviation Comments

Unbound aggregate base layer cut to grade using a CMI trimming machine.

390105 and 390108: Original embankment material placed was unsuitable. Embankment removed and cut down. Now the embankment has 4 feet of fill. Sampling was redone in light of this situation.

 Preparer Mike Pozsgay Date 9-14-1998

LTPP SPS Project Deviation Report Other Deviations	State Code 3 9 Project Code 0 1 0 0

☒ Comments Pertain to All Test Sections on Project

☐ Comments Pertain Only to Section(s): (Specify) _____

Other Deviation Comments

None known.

 Preparer Mike Pozsgay Date 9-14-1998

LTPP SPS Project Deviation Report Site Location Guidelines Deviations	State Code 39 Project Code 0100

☒ Comments Pertain to All Test Sections on Project

☐ Comments Pertain Only to Section(s): (Specify) _____

Site Location Guideline Deviation Comments

None known.

 Preparer Mike Pozsgay Date 9-14-1998

LTPP SPS Project Deviation Report **Data Collection and Materials Sampling and Testing Deviations**	State Code 3 9 Project Code 0 1 0 0

☒ Comments Pertain to All Test Sections on Project

☐ Comments Pertain Only to Section(s): (Specify) _____

Data Collection & Material Sampling and Testing Deviation Comments

Minor deviations noted on sampling data sheets.

 Preparer Mike Pozsgay Date 9-14-1998

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